the ENERGY lab

PROJECT FACTS

Carbon Storage - GSRA

Carbon Dioxide Sealing Capacity: Textural or Compositional Controls?

Background

Fundamental and applied research on carbon capture, utilization and storage (CCUS) technologies is necessary in preparation for future commercial deployment. These technologies offer great potential for mitigating carbon dioxide (CO_2) emissions into the atmosphere without adversely influencing energy use or hindering economic growth.

Deploying these technologies in commercial-scale applications requires a significantly expanded workforce trained in various CCUS technical and non-technical disciplines that are currently under-represented in the United States. Education and training activities are needed to develop a future generation of geologists, scientists, and engineers who possess the skills required for implementing and deploying CCUS technologies.

The U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL), through funding provided by the American Recovery and Reinvestment Act (ARRA) of 2009, manages 43 projects that received more than $12.7 million in funding. The focus of these projects has been to conduct geologic storage training and support fundamental research projects for graduate and undergraduate students throughout the United States. These projects include such critical topics as simulation and risk assessment; monitoring, verification, and accounting (MVA); geological related analytical tools; methods to interpret geophysical models; well completion and integrity for long-term CO_2 storage; and CO_2 capture.

Project Description

NETL has partnered with Brooklyn College to determine the role of textural (e.g., the pore-throat size; distribution, geometry, and sorting; grain size; degree of bioturbation; specific surface area; preferred orientation of matrix clay minerals; and orientation and aspect ratio of organic particles) and compositional parameters (e.g., silt content; ductility; compaction; mineralogical content; proportion of soft, deformable mineral grains to rigid grains; cementation; organic matter content; carbonate content;

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PARTNERS

None

PROJECT DURATION

Start Date
12/01/2009

End Date
11/30/2013

COST

Total Project Value
$296,881

DOE/Non-DOE Share
$296,881 / $0

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and ash content) that control the CO_2 sealing capacity of caprock formations. Caprocks are low-permeability rocks that comprise confining zones located above the CO_2 injection zone and can act as a seal to prevent the upward migration of CO_2 into other formations.

The research is also serving as scientific training for at least one graduate student and one undergraduate student. The students are collecting samples, searching scientific literature, performing most lab measurements, writing scientific dissertations, and participating in disseminating project results through publications and by attending scientific meetings.

Goals/Objectives

The primary objective of the DOE's Carbon Storage Program is to develop technologies to safely and permanently store CO_2 and reduce Greenhouse Gas (GHG) emissions without adversely affecting energy use or hindering economic growth. The Programmatic goals of Carbon Storage research are: (1) estimating CO_2 storage capacity in geologic formations; (2) demonstrating that 99 percent of injected CO_2 remains in the injection zone(s); (3) improving efficiency of storage operations; and (4) developing Best Practices Manuals (BPMs). The objective of the project is to investigate the role of textural and compositional parameters that control the CO_2 sealing capacity of rocks obtained from three gas fields in western Oklahoma (Figure 1). This contributes to the understanding of caprocks and their ability to provide permanent storage of injected CO_2. The research will advance scientific discovery and understanding of CCUS and will be intimately related to promoting CCUS teaching and learning activities at Brooklyn College.

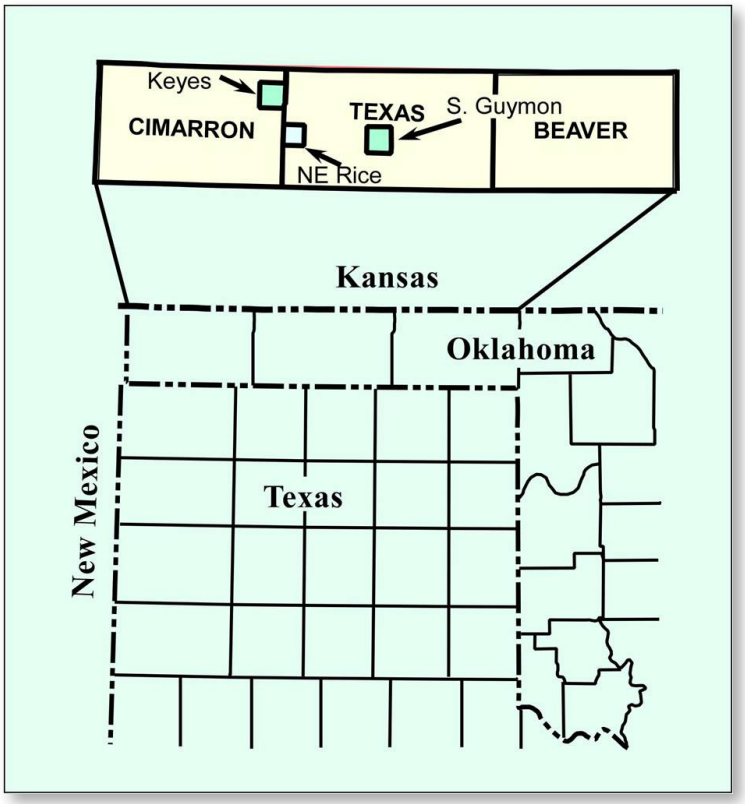

Figure 1. Map indicating the location of the three gas fields (Keys, NE Rice, and S. Guymon) to be investigated in this project.

Accomplishments

- As of March 2012, two students had accumulated 1,398 training related hours under the program.
- A total of 50 cap rock samples were obtained and are currently being analyzed. Students involved in the project have conducted an extensive literature review to identify representative samples and are also being trained on laboratory equipment, including a scanning electron microscope (SEM), particle size analyzer, and a physisorption analyzer.
- A total of 30 samples have undergone grain surface and grain size analysis. Other textural analyses, such has bioturbation, specific surface area, and the preferred orientation of clay matrix minerals have also been conducted. Evaluation of the data that has been collected is currently underway.
- A total of 50 samples have been analyzed by the Autopore Mercury Intrusion Porosimeter. The research team has completed the measuring process and has generated pressure-capillary curves.

Benefits

Overall the project will make a vital contribution to the scientific, technical, and institutional knowledge necessary to establish frameworks for the development of commercial-scale CCUS. Further, it will advance knowledge of the sealing capacity of rocks such as shales and anhydrites and, in turn, provide a better understanding of the processes (including those that contributre to storage permanence) that take place in geologic reservoirs that are subjected to CO_2 injection. The research also fills a gap that exists in the national database regarding the sealing capacity of caprocks, with special reference to existing and potential CCUS targets. Additionally, the project is helping to train students in the skills and competencies that will be required from a workforce needed to implement CCUS technologies on a commercial-scale.

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